I-40 CORRIDOR PROFILE STUDY

I-17 TO ARIZONA/NEW MEXICO BORDER

ADOT Work Task No. MPD 043-15

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Working Paper 1: Literature Review

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PREPARED FOR:

Arizona Department of Transportation

PREPARED BY:

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1. INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this corridor profile study of Interstate 40 (I-40) East between I-17 in Flagstaff and the New Mexico state line. This study will look at key performance measures relative to the I-40 corridor, and use those as a means to prioritize future improvements in areas that show critical deficiencies. The intent of the corridor profile program, and of the Planning to Programming process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network. The I-40 West corridor, west of I-17 extending to the California State Line, has been studied separately as part of a previous round of Corridor Profile Studies.

1.1. Corridor Overview

I-40 corridor is a major east-west transcontinental interstate highway that connects the east coast (Wilmington, NC) to the west coast (Los Angeles, CA). I-40 is a major transportation artery route for freight as well as passenger vehicular traffic, connecting major metropolitan cities in the south-western United States. I-40 is also the primary transportation route connecting the Phoenix metropolitan area to central and north-eastern parts of the country. I-40, together with I-17 plays a key role in the transportation infrastructure of northern Arizona, contributing to its economic success.

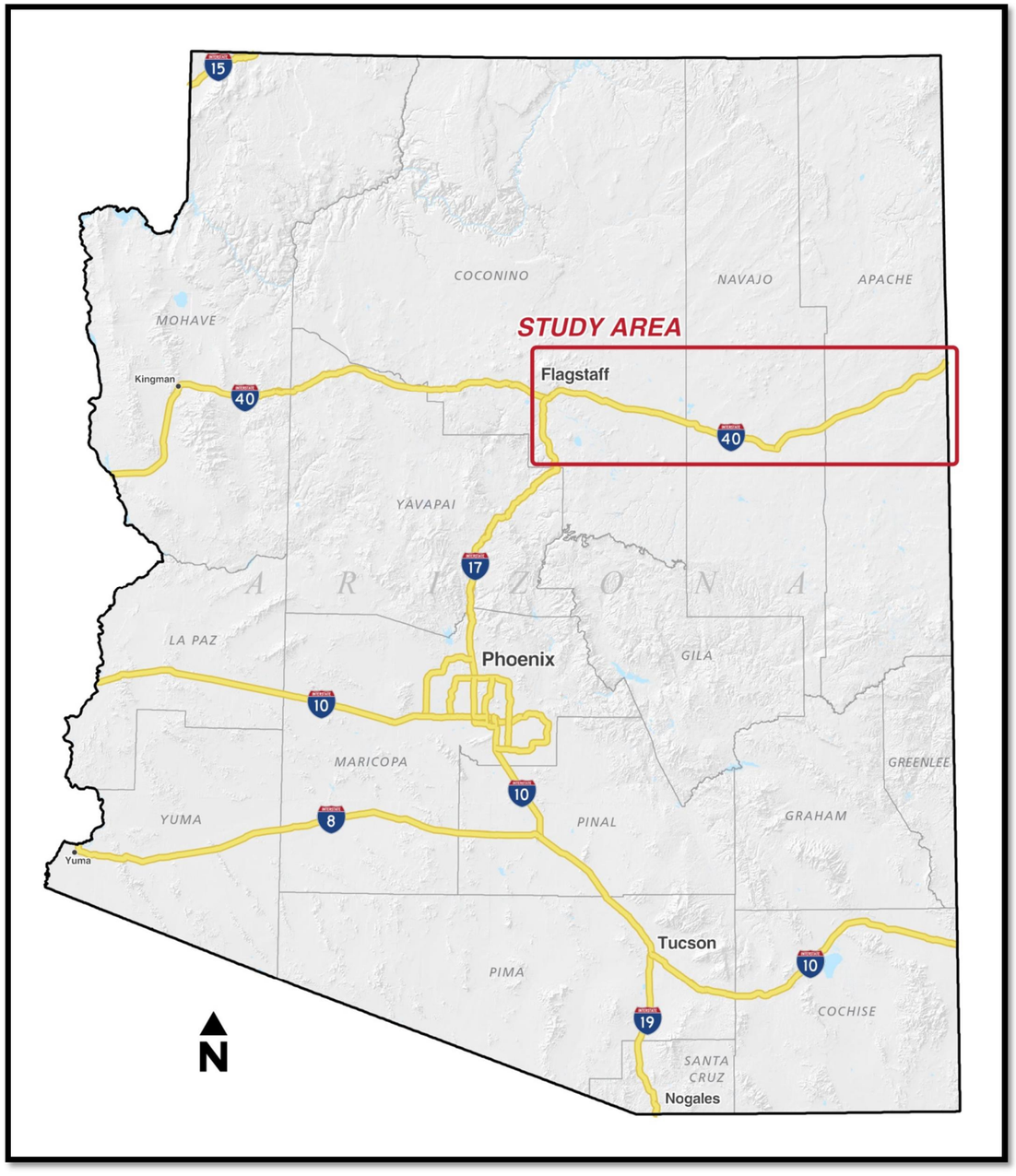
I-40 provides the most direct and fastest link between Flagstaff (and Grand Canyon National Park), central and north-eastern United States to the east, and major Californian Cities to the west (Figure 1). I-40 provides a principal road link for freight traffic from the ports in California (Figure 2). This study builds on earlier planning efforts in developing and applying a performance-based process for prioritizing improvements to meet present and future needs in the corridor.

1.2. Corridor Study Purpose

ADOT has instituted a new corridor planning approach to develop strategies and tools that incorporate life-cycle cost analysis and risk assessment to measure system performance. This Corridor Profile Study will follow the new process established by previous corridor profile studies for I-17, I-19 and I-40, to:

- Inventory past improvement recommendations.
- Assess the existing performance based on quantifiable performance measures.
- Propose various solution sets to improve corridor performance.
- Identify specific projects that can provide quantifiable benefits in relation to the performance measures.

Figure 1: Study Location Map



1.3. Corridor Study Objective

The objective of this study is to identify a recommended set of potential projects for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process.

1.4. Working Paper Objectives

The objectives of Working Paper # 1 are to provide a summary of recent plans and studies related to the I-40 Corridor, identify their recommendations for each corridor segment defined in Section 1.5, and develop an understanding of the current ultimate plan for the corridor.

The literature review includes related plans and studies completed within the last ten years. These previous studies recommended specific projects along I-40, many of which have not been implemented. The recommended improvements are summarized in **Appendix A**.

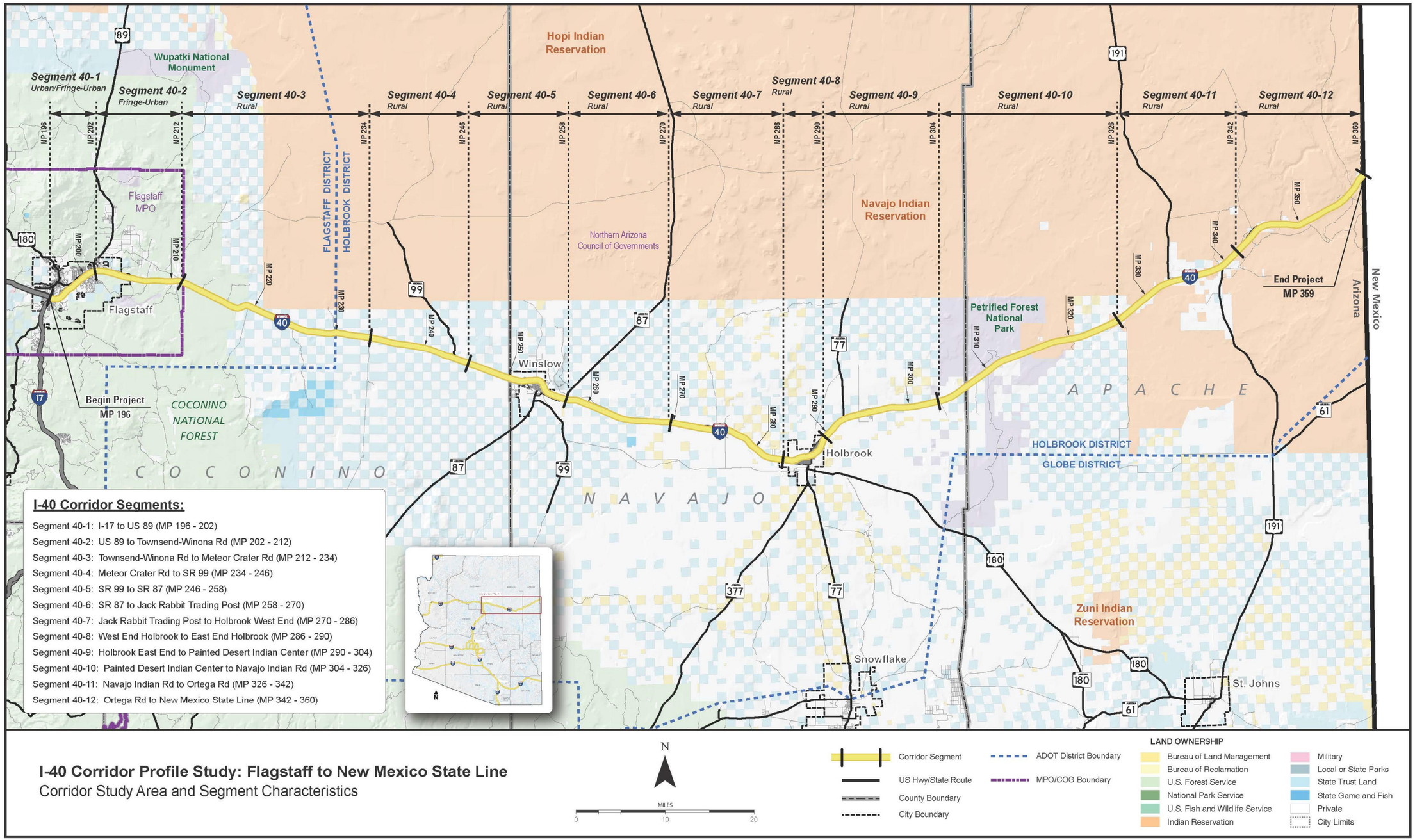
1.5. Study Location and Corridor Segments

The I-40 corridor is 164 miles long, from I-17 (MP 196.0) to Arizona/New Mexico State Line (MP 359.0). The corridor has been divided into 12 distinct segments based on regionally significant intersecting routes, changes in topography, or natural or man-made landmarks along the corridor. The shortest segment is four miles long and the longest, a little over seventeen miles. Corridor Segments have been described in Table 1 below, and shown on a map in Figure 2.

Table 1: Corridor Segmentation

Segment #	Segment Description	Character Description
Segment 1	I-17 to US 89 (MP 196 to MP 202)	This segment is generally urban/fringe-urban in nature, includes three interchanges, and is within the urbanized limits of the Flagstaff Metropolitan Area in Coconino County.
Segment 2	US 89 to Townsend-Winona Road (MP 202 to MP 212)	This segment is urban-fringe in nature, includes three interchanges, and is within Coconino County.
Segment 3	Townsend-Winona Road to Meteor Crater Road (MP 212 to MP 234)	This segment is generally rural in nature, includes four interchanges, and is within Coconino County.
Segment 4	Meteor Crater Road to SR 99 (MP 234to MP 246)	This segment is rural in nature, includes two interchanges, and within Coconino County.
Segment 5	SR 99 to SR 87 (MP 246 to MP 258)	This segment is rural in nature, includes four interchanges, and spans Coconino and Navajo Counties. This segment passes through Winslow.
Segment 6	SR 87 to Jack Rabbit Trading Post (MP 258 to MP 270)	This segment is rural in nature, includes two interchanges, and is located within Navajo County.
Segment 7	Jack Rabbit Trading Post to Holbrook West End (MP 270 to MP 286)	This segment is rural in nature, includes four interchanges, and is located within Navajo County.
Segment 8	Holbrook West End to Holbrook East End (MP 286 to MP 290)	This segment is rural in nature, includes three interchanges, and is located within Navajo County. This segment passes through Holbrook.
Segment 9	Holbrook East End to Painted Desert Indian Center (MP 290 to MP 304)	This segment is rural in nature, includes four interchanges, and is located within Navajo County.
Segment 10	Painted Desert Indian Center to Navajo Indian Road (MP 304 to MP 326)	This segment is rural in nature, includes three interchanges, and spans Navajo and Apache Counties.
Segment 11	Navajo Indian Road to Ortega Road (MP 326 to MP 342)	This segment is rural in nature, includes three interchanges, and is located within Apache County.
Segment 12	Ortega Road to New Mexico State Line (MP 342 to MP 359.63)	This segment is rural in nature, includes seven interchanges, and is located within Apache County.

Figure 2: Project Vicinity/Segmentation Map



2. LITERATURE REVIEW

This section provides a summary of relevant studies and plans and their recommendations that are relevant to the I-40 East Corridor Profile Study. The reviewed plans and studies have been classified into three categories:

- Corridor-Specific Studies/Plans (Design Concept Reports, corridor profiles, etc.)
- Statewide and Regional Studies/Plans (State Transportation Plan, State Rail Plan, statewide pedestrian and bicycle studies, etc.)
- Funding Programs (Regional Transportation Plan, long-range transportation plans, etc.)

Detailed listings of recommended improvements along each segment are provided in Appendix A. Recommended corridor improvements along the I-40 East corridor are also shown graphically in Figure 3.

2.1. Corridor Specific Studies/Plans

Interstate 40/North Park Drive Traffic Interchange Final Design Concept Report, ADOT

Author: Michael Baker Jr., Inc.
Date Published: March 2002

ADOT completed this Final Design Concept Report (FDCR) in March 2002. The study summarized the selection process of the recommended alternative for improvements to the I-40/North Park Drive traffic interchange in the City of Winslow, in Navajo County, Arizona. The interchange is located at Milepost (MP) 253.6 on I-40. The I-40 corridor is a major east-west corridor, connecting Los Angeles (CA) on the west coast to Wilmington (NC) on the east coast, and carries significant volumes of truck traffic. As a result, areas around the interchange have experienced growth in commercial and retail service sectors.

The following recommendations were identified in this study:

- Retain diamond interchange configuration of the existing interchange.
- Replace the overpass to correct the deficient deck and vertical clearance issues.
- Widen North Park Drive to two through lanes in each direction with side-by-side turn-lanes.
- Realign North Road to north of Mike's Pike.
- Address drainage issues as part of North Park Drive widening.
- Relocate Visitor Center because of ramp modifications and change in access control.

Construction of the I-40/North Park Drive TI has been completed by ADOT.

I-40 Lupton Traffic Interchange Final Design Concept Report, ADOT

Author: EPS Group, Inc.
Date Published: September 2012

ADOT completed the Final DCR for the Lupton traffic interchange (MP 359.21) in September 2012. Since the project was not listed in the ADOT Five-Year Program, an Environmental Assessment (EA) was not completed at the time due to fiscal constraint requirements. The Draft EA was put on file (not distributed to cooperating agencies and FHWA) and will become a reference document for the future design team when the NEPA document is completed.

The FDCR identified and recommended specific solutions to address the traffic, safety, structural, drainage, access, and pedestrian issues associated with the I-40 Lupton TI while limiting and/or mitigating environmental and socioeconomic impacts. Two alternatives were developed based on traffic needs, safety and design criteria. The second alternative was selected as the recommended alternative since it involves far fewer impacts to existing businesses, creates greater sight distances, allows for pedestrian facilities to be more easily accommodated, and greatly enhances constructability.

The following recommendations were identified in this study:

- Construct a new diamond traffic interchange approximately 800 feet west of the existing TI location.
- Construct two new overpass bridge structures at the new TI location (owing to relocation of the TI).
- Modify the alignment of the frontage road north of I-40 to provide greater separation between TI intersections.
- Build a new drainage system to alleviate the current flooding issues.
- Build a new crossroad to provide the desirable vertical clearance under the overpass bridges.

The estimated design and construction cost of the recommended alternative is $16,770,000. This estimate includes right-of-way acquisition and prior rights utility relocation. Design and construction of this project were not listed in the 2013-2017 ADOT Five-Year Transportation Facilities Construction Program.

I-40, Bellemont to Winona, Draft Final Design Concept Report, ADOT

Author: Stanley Consultants, Inc.
Date Published: August 2013

ADOT completed the Draft Final DCR for the section of I-40 between Bellemont and Winona in August 2013. The design concept study and related environmental studies were initiated by ADOT and FHWA to evaluate proposed improvements to I-40 in Coconino County, Arizona. Improvements include addition of capacity to I-40 from west of the Bellemont TI at MP 183 to east of the Winona TI at MP 214, within the ADOT's Flagstaff district.

The study recommends a long-range implementation strategy that will guide future decisions regarding the interim and ultimate improvements required to modify I-40 to meet the capacity and operational needs of the traveling public over the next 25-30 years.

The study recommended the following improvements to I-40:

- Widen the mainline to three lanes in each direction
- Spot improvements to address superelevation
- Address vertical stopping sight distance and grade issues
- Widen and replace bridges
- Reconstruct existing interchanges, and
- Construct two new interchanges

It is recommended that widening the corridor should generally include inside widening. Outside widening or reconstruction would be used at specific locations where terrain or lane configurations dictate:

- MP 188–MP 189 (S-curve rockfall containment area): Outside widening is recommended for the eastbound and westbound alignments in this segment, as well as re-profiling of the existing roadways.
- MP 190–MP 193 (Riordan Railroad Crossing): The eastbound and westbound horizontal alignments through this section will be modified to straighten the existing S-curve over the Burlington Northern Santa Fe railroad tracks and improve the superelevation.
- MP 193–MP 194 (Woody Mountain Road): Eastbound and westbound I-40 will be re-aligned toward the inside median and lowered to improve the approach grades of the Woody Mountain Road crossing and accommodate the potential new interchange and trail crossing.
- MP 199–MP 200 (Fourth Street rockfall containment area): The eastbound and westbound alignments will be re-aligned toward the median to mitigate rockfall issues.

The study proposed two new traffic interchanges at:

- Woody Mountain TI (MP 193.5) – not within the current study area.
- Lone Tree TI (MP 196.7) – A new TI is proposed. A recommended alternative has not been identified; however, it is recommended that the Braided-Over and Braided-Under I-40 alternatives be carried forward for further consideration and public comment.
- Butler TI (MP 198.28) – Reconstruction of the existing TI is proposed.
- Country Club TI (MP 201.1) – Minor Improvements are proposed to the existing TI.
- Walnut Canyon TI (MP 204.8) – Reconstruction of the existing TI is proposed.
- Cosnino TI (MP 207.24) – Minor Improvements are proposed to the existing TI.
- Winona TI (MP 211.16) – Reconstruction of the existing TI is proposed.

A new interchange at US 89 (MP 202.3) was evaluated in the Initial Design Concept Report but was not part of the recommended improvements included in the Final Design Concept Report.

The estimated total cost for the design and construction of the overall project is $649,434,290 (in 2013 dollars), excluding the cost of the new right-of-way. The project outlines an implementation plan with 21 phases for the construction of this project. Each construction phase would be non-concurrent and operationally independent.

This project is not programmed in ADOT's 2014–2018 Five-Year Transportation Facilities Construction Program and the project schedule is unknown.

2.2. Statewide and Regional Studies/Plans

Building a Quality Arizona (bqAZ) Statewide Transportation Planning Framework Study, ADOT

Author: AECOM
Date Published: March 2010

ADOT completed the bqAZ Statewide Transportation Planning Framework Study in 2010. Its purpose was to identify Arizona's multimodal transportation needs through 2050.

The recommended framework is a 40-year vision for the future, including not only multimodal transportation improvements, but also policies and programs to address climate change, urban form, environmental stewardship, economic vitality, and safety and security. Network recommendations identified in the study include various new and improved roadways, rail corridors, and transit service.

Recommendations in northern Arizona affecting I-40 include:

- Widen all Interstate Highways, including I-40, to six lanes in rural Arizona.
- Local transit service (e.g., fixed route, community circulator, dial-a-ride) in Flagstaff, Winslow, and Holbrook.
- Major transit centers in Flagstaff, Winslow, and Holbrook.
- Minor transit centers at Petrified National Forest, and in Lupton.
- Intercity bus service along I-40.
- Enhanced passenger rail service along the BNSF Transcontinental (Transcon) Route.
- Potential southwest interstate high-speed rail corridor.

Implementation of the recommended network would occur through the state's Long Range Transportation Plan (LRTP) and more specific (state, regional, and local) capital improvement programming.

Arizona State Rail Plan

Author: AECOM
Date Published: March 2011

As a follow-on step to the Statewide Rail Framework Study (part of the bqAZ Statewide Transportation Planning Framework Program), ADOT initiated the preparation of a State Rail Plan that responds to the requirements of the 2008 Passenger Rail Investment and Improvement Act. The State Rail Plan is based on the research and findings of the Statewide Rail Framework Study completed in October 2009. The State Rail Plan provides a 20-year implementation program and capital plan for statewide rail investment that includes the enhancement of freight rail infrastructure, and identifies the steps to institute intercity passenger rail services along key routes (e.g., Phoenix-Tucson, Tucson-Nogales, Phoenix-Flagstaff). The State Rail Plan resulted in development of a Rail Action Plan for immediate, intermediate, and long-range timeframes, together with funding strategies.

The plan identifies the following four "corridors of opportunity" for freight and passenger rail improvements:

1. Arizona Spine (proposed) - north to south corridor through the central part of the state
2. CANAMEX Corridor (proposed) - spans from Las Vegas to the international border with Mexico
3. Route 66 Corridor (existing) - east to west corridor, generally following the BNSF Railway Transcon Corridor and I-40
4. Sunset Corridor (existing) - east to west corridor, generally following the Union Pacific Railroad (UPRR) Sunset Corridor and Interstates 8 and 10.

The plan recommends corridor-specific actions for implementation of freight improvements and passenger rail services. These include:

- Partner with Amtrak to improve service along the Southwest Chief Route, and explore feasibility of additional Amtrak service between southern California and Flagstaff.
- Partner with Grand Canyon Railway and White Mountain Apache community to explore the feasibility of expanding tourist railroad services.
- Partner with private sponsors to plan and implement new intermodal and freight logistics facilities.
- Complete corridor studies and obtain environmental clearance for extension of intercity rail system north of Phoenix.
- Implement feasible improvements within communities, such as: Quite Zones, rail realignments, or other improvements.

The recommendations for each corridor of opportunity (discussed above) have been classified into short-term (within 5 years), medium-term (within 10 years), and long-term (within 20 years).

http://www.azdot.gov/docs/planning/state-rail-plan.pdf?sfvrsn=0

Arizona Multimodal Freight Analysis Study, ADOT

Author: Arizona Department of Transportation (ADOT)
Date Published: 2008

ADOT completed the Multimodal Freight Analysis Study in 2008. This study addressed all modes of freight transportation in Arizona – trucking, rail and aviation – to provide a detailed assessment of critical freight issues and emerging trends, as well as their relationship to transportation policy and infrastructure. From this information, infrastructure needs and deficiencies were identified, as was a recommended strategy for including freight analysis as part of Arizona's long-range planning process.

This study resulted in six high-level strategic directions:

- Strengthen the relationship between freight and economic development: Engage the private sector in transportation planning, and market the link between transportation and Arizona's economy, working with the Arizona Department of Commerce (now the Arizona Commerce Authority).
- Coordinate freight planning with local land use planning: Support local government efforts to develop land use planning guidelines for freight-intensive development, and encourage communities to work closely with the private sector when developing freight logistics centers.

- Preserve and prioritize key freight operations: Support railroad mainline expansions, protect priority highway corridors for efficient freight movement, and establish/maintain a freight data collection program.
- Enhance freight system safety and security: Incorporate heavy truck movements in highway design, expand Arizona's highway network for freight, and use innovative technology (e.g., ITS) to improve highway operations for commercial vehicles.
- Seek opportunities to improve freight operations: Target improvements at truck crash "hot spots," provide safe and secure truck parking locations, monitor/improve the safety of railroad crossings that have a crash history, and implement performance-based truck size and weight enforcement policies.
- Promote environmental preservation and energy efficiency: Encourage green initiatives in the freight sector to reduce energy consumption and consider alternatives to highways for moving large volumes of freight between southern California and Arizona.

The study did not identify any recommendations specific to the I-40 Corridor nor did it discuss funding and implementation strategies.

http://repository.asu.edu/attachments/109262/content/Arizona%20Multimodal%20Freight%20Study_FinalReport.pdf

Statewide Bicycle and Pedestrian Plan Update, ADOT

Author: Kimley-Horn and Associates, Inc.
Date Published: June 2013

ADOT updated the Statewide Bicycle and Pedestrian Plan in 2013. The purpose of this plan, which replaced the 2003 version, was to establish a vision for bicycling and walking in Arizona, goals and objectives to measure progress toward the vision, and strategies and actions needed to achieve the vision, goals, and objectives.

The plan applies to the entire state of Arizona, focusing particularly on the State Highway System. **The plan did not identify any recommendations specific to the I-40 Corridor.**

http://wwwa.azdot.gov/ADOTLibrary/Multimodal_Planning_Division/Bicycle-Pedestrian/Bicycle_Pedestrian_Plan_Update-Final_Report-1306.pdf

2003 Climbing Lane Prioritization Update, ADOT

Author: Lima & Associates

Date Published: May 2004

This study identifies and prioritizes climbing lane projects to be considered for inclusion in the Five-Year Construction Program. A list of prioritized climbing and passing lane projects was produced using the prioritization process developed in a previous Climbing Lane Prioritization project.

The study identified a total of 34 potential candidate locations for climbing lanes on Arizona's multilane highways, none of which are along the I-40 corridor east of I-17.

http://wwwa.azdot.gov/ADOTLibrary/Multimodal_Planning_Division/Studies/2003_Climbing_Lane_Prioritization-Update-FR-0405.pdf

Climbing and Passing Lane Prioritization Study, ADOT

Author: Jacobs Engineering Group

Date Published: February 2015

ADOT completed a climbing and passing lane study in February 2015 that developed a needs-based prioritization for climbing and passing lane locations on the Arizona State Highway system.

The study identified and prioritized locations along major highways where passing lanes are recommended. Several locations were identified along I-40, none of which are located along the study limits of the current study.

http://www.azdot.gov/planning/CurrentStudies/climbing-and-passing-lane-prioritization-study

Statewide Dynamic Message Sign (DMS) Master Plan, ADOT

Author: Lee Engineering, LLC
Date Published: November 2011

The purpose of the Statewide DMS Master Plan was to provide specific justification, warrants, criteria, and consideration for permanent DMS design requirements for the Arizona highway system.

The following DMS locations along the I-40 corridor have been identified in the master plan:

1. Existing
   - MP 199.8 – Eastbound, between 4th Street and Country Club
   - MP 212.1 – Westbound, east of Winona Exit #211
   - MP 250.7 – Eastbound, west of Hipkoe Drive
   - MP 260.2 – Westbound, 3 miles east of SR 87
   - MP 281.0 – Eastbound, east of Main Street
   - MP 295.2 – Westbound, east of SR 77

- MP 310.1 – Eastbound, west of US 191
- MP 330.4 – Eastbound, east of McCarrol Road
- MP 358.0 – Westbound, 1 mile west of New Mexico border

2. Under Design/Construction
   - MP 197.6 – Westbound, west of Butler Avenue
   - MP 340.4 – Westbound, east of US 191
3. Proposed
   - MP 199.8 – Westbound, between 4th Street and Country Club

http://www.azdot.gov/docs/default-source/business/dms-masterplan.pdf?sfvrsn=2

2.3. Funding Programs

What Moves You Arizona Long-Range Transportation Plan 2010-2035, ADOT

Author: Wilbur Smith Associates
Date Published: November 2011

The purpose of the plan is to serve as both the principal high-level capital programming guide for ADOT and as documentation of broader statewide transportation investment needs. The plan replaced MoveAZ, ADOT's previous LRTP completed in 2004.

The report specifies a number of traditional and innovative funding strategies that must be pursued to meet the state's transportation needs over the next 25 years. None refer specifically to the I-40 corridor.

Implementation strategies were identified for Mobility, Accessibility and Connectivity; Preservation and Maintenance; Economic Development; Transportation and Land Use; Natural, Cultural and Environmental Resources; Safety and Security; and Performance Measurement and Management.

The plan proposed quantitative performance measures in the following areas:

- Improve Mobility and Accessibility (e.g., speed, delay, volume/capacity)
- System Preservation and Maintenance (e.g., pavement and bridge condition metrics)
- Support Economic Growth (e.g., number of jobs created or retained, as well as mobility measures)
- Link Transportation and Land Use (mobility measures, level of improved access management)
- Consider Natural, Cultural and Environmental Resources (e.g., change in vehicle emissions)
- Enhance Safety and Security (number of crashes and fatalities by mode)
- Strengthen Partnerships (to be measured qualitatively)
- Promote Fiscal Stewardship (relative benefits of investment choices)

http://www.azdot.gov/docs/default-source/planning/lrtp-2011-1129.pdf?sfvrsn=2

2016-2020 Five-Year Transportation Facilities and Construction Program

Author: Arizona Department of Transportation (ADOT)
Date Published: June 2015

The purpose of the Five-Year Transportation Facilities Construction Program is to comply with Arizona Revised Statutes §28-304, to set forth the short-term program for developing projects, and to account for the spending of funds for the next five years.

The program identifies the following projects, specific to the I-40 corridor:

- Bridge replacement and rehabilitation at I-17/I-40 Traffic Interchange (MP 195) – 2 miles
- Bridge replacement and rehabilitation at Butler Avenue TI Overpass and 4th Street Overpass (MP 198) – 2 miles
- Bridge replacement and rehabilitation at Twin Arrows TI Underpass (MP 219)
- Bridge replacement and rehabilitation at Canyon Diablo Bridges EB and WB (MP 229)
- Rest area preservation at Painted Cliffs and Meteor Crater rest areas (MP 235)
- Bridge replacement and rehabilitation at Meteor City TI Overpass EB and WB (MP 239)
- Bridge replacement and rehabilitation at Cottonwood Bridge EB and WB (MP 259)
- Pavement preservation from Jackrabbit Road (MP 268) to Joseph City (MP 278)
- Rockfall mitigation along I-40 from MP 279.2 to MP 279.7
- Sign rehabilitation at Goodwater – Yellowhorse (MP 297)
- Pavement preservation from Sun Valley Road (MP 297) to Washboard Road (MP 303)
- CBC extension at MP 298 Utility Overpass
- Design drainage improvements at Adamana TI (MP 303)
- Pavement preservation from Allentown Road (MP 354) to State Line (MP 360)

The first two years of the program are financially constrained by year. All projects in those years will be fully funded and ready to advertise in the year programmed or sooner, as determined by the State Transportation Board.

http://www.azdot.gov/docs/default-source/transportation-programming/2015-2019-program.pdf?sfvrsn=4

Flagstaff Pathways 2030 Regional Transportation Plan, FMPO

Author: Flagstaff Metropolitan Planning Organization (FMPO)
Date Published: October 2009

The FMPO RTP Update was adopted by the FMPO Executive Board on December 16, 2009. FMPO is the federally recognized regional transportation planning organization for the Flagstaff area. Its membership includes Coconino County, the City of Flagstaff, and ADOT. FMPO is responsible for multimodal transportation planning in a 525-square-mile area.

The purpose of the Flagstaff Pathways 2030 RTP is to identify and prioritize future transportation investments for the Flagstaff region for driving, transit, walking, biking, and goods movement. The RTP evaluates the cost and effectiveness of projects for each travel mode, as well as addressing the relationships between land use, transportation, the economy, and the environment.

> The RTP recommends widening of I-40 and construction of interchanges based on the recommendations of the I-40, Bellemont to Winona, Design Concept Report.

The plan identified multiple funding sources, including sales tax, Highway User Revenue Fund, Transportation Enhancement (TE) grants, and various federal funding programs.

http://www.flagstaff.az.gov/DocumentCenter/Home/View/10092

3. SUMMARY AND CONCLUSIONS

3.1. Corridor Development History

The I-40 East corridor between Flagstaff and New Mexico state line was originally built between 1959 and 1984. I-40 replaced the historic Route 66 in Arizona, with most of the corridor following the existing Route 66 alignment. Some sections of I-40 had to bypass cities and towns to avoid going through existing commercial development. These sections of Route 66 were converted to I-40 Business Routes.

A majority of the existing traffic interchanges (TIs) and other grade separations were built concurrently with the original freeway. Over the last several years, ADOT has focused on corridor preservation, and invested in new infrastructure along the corridor, including:

- New traffic interchange at North Park Drive (MP 253.6)

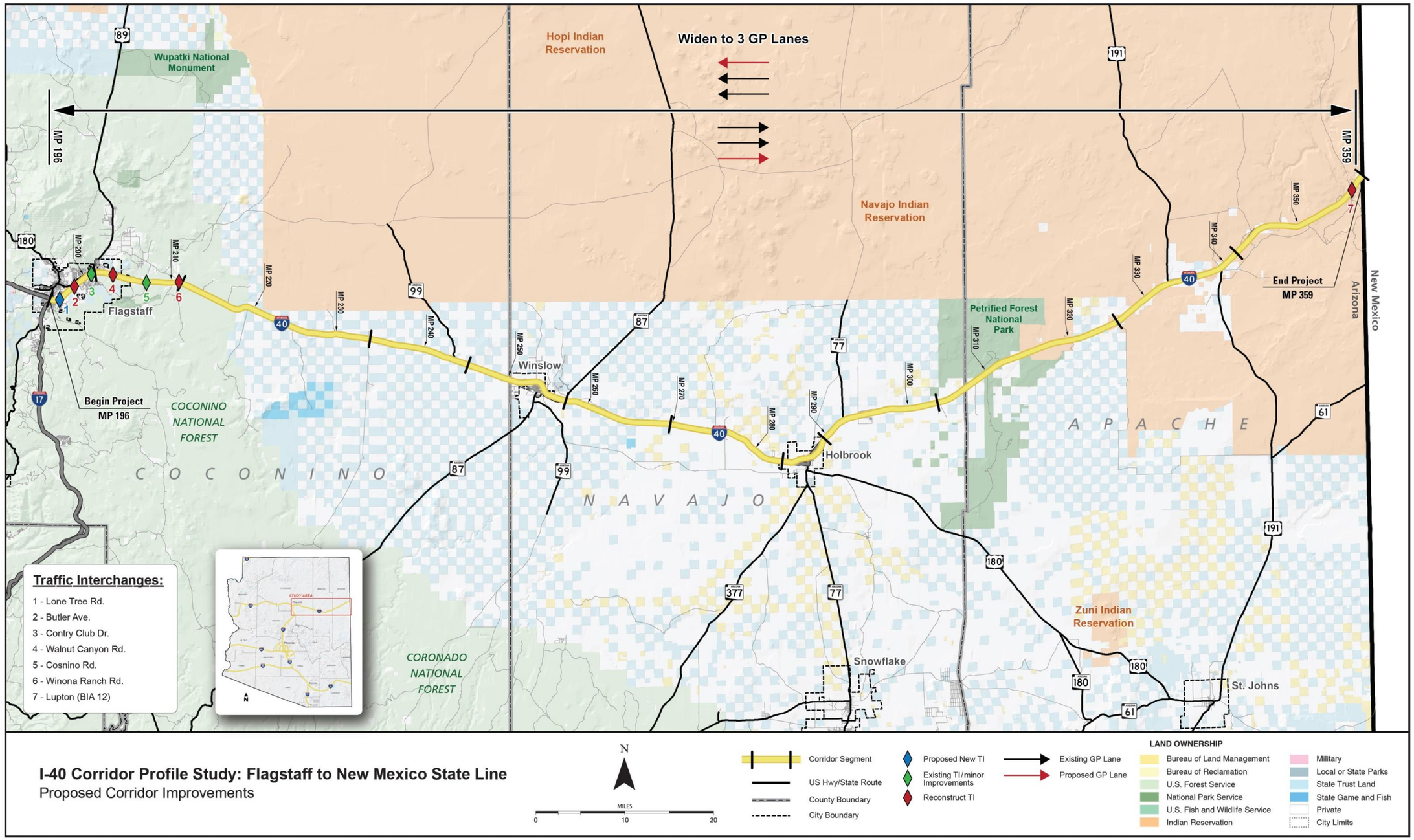
3.2. Recommendations Not Implemented

Various studies and plans, including Design Concept Reports (DCRs), have recommended additional improvements for the I-40 Corridor. They include, but are not limited to:

- Widening of I-40 to six lanes (three general purpose lanes in each direction), some of which will require right-of-way acquisition. Many other proposed improvements are associated with the recommended widening.
- Reconstruction of a traffic interchange at Lupton (MP 359.21)
- Construct a new TI at Lone Tree (MP 196.7)
- Reconstruct the existing Butler TI (MP 198.28)
- Minor Improvements to the existing Country Club TI (MP 201.1)
- Reconstruct the existing Walnut Canyon TI (MP 204.8)
- Minor Improvements to the existing Cosnino TI (MP 207.24)
- Reconstruct the existing Winona TI (MP 211.16)
- Bridge replacement or widening to support the additional mainline travel lanes
- ITS improvements, such as closed circuit television and dynamic message signs

The previous studies and plans reviewed in Chapter 2 contain a wide range of recommendations for improvements in the I-40 Corridor. The current ultimate plan for the I-40 corridor is summarized in Figure 3.

Figure 3: Ultimate Recommended Plan for I-40



Appendix A – Literature Review: Corridor Recommendations Matrices

Table A: Corridor Specific Studies/Plans

Name of Study	Recommendations		Notes	Status (Completed/Not Yet Implemented)
	Description	Location or Begin Milepost		
Segment 1: I-17 to US 89 (MP 195.44 to MP 202)				
I-40, Bellemont to Winona, Draft Final Design Concept Report	Widen the mainline to three lanes in each direction (inside widening)	MP 195.44 - MP 202	This project would widen the mainline pavement to the inside from MP 183.6 to MP 208.4, adding pavement to the median side of the eastbound and westbound roadways and maintaining the outside edge of pavement in its current location. By retaining the existing outside edge of pavement, impacts to the outside of the existing roadway are minimized. The new inside travel lanes for each direction would be separated by an open median with a minimum width of 148 feet (measured between travel lanes) for much of the project length. At the Riordan railroad bridges, the eastbound and westbound I-40 roadways would be realigned toward the median, and the median width would be less than 75 feet. Within the realigned portion of I-40 near the Riordan railroad bridges, median barrier would be installed to separate the opposing roadways. At the Fourth Street bridge, median barrier is also required because the piers will be in the clear zone.	
	Spot improvements to address superelevation			
	Address vertical stopping sight distance and grade issues			
	Widen and replace bridges			
	Reconstruct existing interchanges			
	Construct new interchange at Lone Tree TI	MP 196.7		
	Reconstruct the existing Butler TI	MP 198.28		
	Minor Improvements to the existing Country Club TI	MP 201.1		
Segment 2: US 89 to Townsend-Winona Road (MP 202 to MP 212)				
I-40, Bellemont to Winona, Draft Final Design Concept Report	Widen the mainline to three lanes in each direction (inside widening)	MP 202 - MP 212	This project would widen the mainline pavement to the inside from MP 183.6 to MP 208.4, adding pavement to the median side of the eastbound and westbound roadways and maintaining the outside edge of pavement in its current location. By retaining the existing outside edge of pavement, impacts to the outside of the existing roadway are minimized. The new inside travel lanes for each direction would be separated by an open median with a minimum width of 148 feet (measured between travel lanes) for much of the project length. At the Riordan railroad bridges, the eastbound and westbound I-40 roadways would be realigned toward the median, and the median width would be less than 75 feet. Within the realigned portion of I-40 near the Riordan railroad bridges, median barrier would be installed to separate the opposing roadways. At the Fourth Street bridge, median barrier is also required because the piers will be in the clear zone.	
	Spot improvements to address superelevation			
	Address vertical stopping sight distance and grade issues			
	Widen and replace bridges			
	Reconstruct existing interchanges			
	Reconstruct the existing Walnut Canyon TI	MP 204.8		
	Minor Improvements to the existing Cosnino TI	MP 207.24		
	Reconstruct the existing Winona TI	MP 211.16		
Segment 3: Townsend-Winona Road to Meteor Crater Road (MP 212 to MP 234)				
I-40, Bellemont to Winona, Draft Final Design Concept Report	Widen the mainline to three lanes in each direction (inside widening)	MP 212 - MP 214	This project would widen the mainline pavement to the inside from MP 183.6 to MP 208.4, adding pavement to the median side of the eastbound and westbound roadways and maintaining the outside edge of pavement in its current location. By retaining the existing outside edge of pavement, impacts to the outside of the existing roadway are minimized. The new inside travel lanes for each direction would be separated by an open median with a minimum width of 148 feet (measured between travel lanes) for much of the project length. At the Riordan railroad bridges, the eastbound and westbound I-40 roadways would be realigned toward the median, and the median width would be less than 75 feet. Within the realigned portion of I-40 near the Riordan railroad bridges, median barrier would be installed to separate the opposing roadways. At the Fourth Street bridge, median barrier is also required because the piers will be in the clear zone.	
	Spot improvements to address superelevation			
	Address vertical stopping sight distance and grade issues			
	Widen and replace bridges			
	Reconstruct existing interchanges			
Segment 4: Meteor Crater Road to SR 99 (MP 234to MP 246)				
None				
Segment 5: SR 99 to SR 87 (MP 246 to MP 258)				
None				
Segment 6: SR 87 to Jack Rabbit Trading Post (MP 258 to MP 270)				
I-40 Lupton Traffic Interchange Final Design Concept Report	Construct a new diamond traffic interchange approximately 800 feet west of the existing TI location	MP 359.21	The TI will be relocated approximately 800 feet to the west. This will move the interchange away from the cliffs which increases the ability to improve the geometrics of the TI by further separating the ramps from the frontage roads. New ramps, crossroad, and bridges will be constructed in accordance with ADOT standards. The new TI will provide a level of service (LOS) of "B" for the TI in the 2040 design year. The ramps will be taper-type and will consist of a single 12-foot lane with a 2-foot left shoulder and an 8-foot right shoulder. The crossroad will consist of one 12-foot through lane in each direction, dual opposing 12-foot left turn lanes between the ramp intersections, 4-foot shoulders, curb and gutter, and 5-foot sidewalks on both sides. There will also be a dedicated left turn lane at the intersection with the north frontage road (Grants Road). The crossroad will be built to provide the desired 16'-6" vertical clearance under the I-40 overpass bridges. It will also be designed to provide the desired vertical clearance should additional lanes be added to I-40 in the future. The existing overpass bridge structures will be removed as part of the proposed work. The north frontage road will be shifted to the northwest to provide as much separation between the frontage road and the ramp intersections as practical. It will consist of one 12-foot lane in each direction with 4-foot shoulders on both sides. In order to shift the north frontage road to the northwest, one existing business and a volunteer fire station currently located along the frontage road will need to be removed. The new frontage road will continue to provide access to the rest area, the remaining businesses, and other local roads. A portion of the eastbound on-ramp (Historic Route 66) will be removed and the remainder will be converted into a cul-de-sac to provide access to the existing commercial properties and the ADOT materials storage area located just southeast of the existing TI. This will also include a reconstruction of the existing drainage system. The proposed storm drain system will carry stormwater south to the Puerco River. New catch basins will be installed to collect water from the frontage roads, ramps, and crossroad to eliminate the current flooding that occurs on the existing crossroad. An outlet structure will also be installed at the discharge location into the Puerco River.	
	Construct two new overpass bridge structures at the new TI location (owing to relocation of the TI)			
	Modify the alignment of the frontage road north of I-40 to provide greater separation between TI intersections			
	Build a new drainage system to alleviate the current flooding issues			
	Build a new crossroad to provide the desirable vertical clearance under the overpass bridges			
Segment 7: Jack Rabbit Trading Post to Holbrook West End (MP 270 to MP 286)				
None				
Segment 8: Holbrook West End to Holbrook East End (MP 286 to MP 290)				
None				
Segment 9: Holbrook East End to Painted Desert Indian Center (MP 290 to MP 304)				
None				
Segment 10: Painted Desert Indian Center to Navajo Indian Road (MP 304 to MP 326)				
None				

Name of Study	Recommendations		Notes	Status (Completed/Not Yet Implemented)
	Description	Location or Begin Milepost		
Segment 11: Navajo Indian Road to Ortega Road (MP 326 to MP 342)				
None				
Segment 12: Ortega Road to New Mexico State Line (MP 342 to MP 359.63)				
None				

Table B: Statewide and Regional Studies/Plans

Name of Study	Recommendations	
	Description	Location or Begin Milepost
Segment 1: I-17 to US 89 (MP 195.44 to MP 202)		
Statewide Dynamic Message Sign (DMS) Master Plan	DMS design/construction on I-40 Westbound, west of Butler Avenue	MP 197.6
	DMS proposed on I-40 Westbound, between 4th Street and Country Club	MP 199.8
Segment 2: US 89 to Townsend-Winona Road (MP 202 to MP 212)		
None		
Segment 3: Townsend-Winona Road to Meteor Crater Road (MP 212 to MP 234)		
None		
Segment 4: Meteor Crater Road to SR 99 (MP 234to MP 246)		
None		
Segment 5: SR 99 to SR 87 (MP 246 to MP 258)		
None		
Segment 6: SR 87 to Jack Rabbit Trading Post (MP 258 to MP 270)		
None		
Segment 7: Jack Rabbit Trading Post to Holbrook West End (MP 270 to MP 286)		
None		
Segment 8: Holbrook West End to Holbrook East End (MP 286 to MP 290)		
None		
Segment 9: Holbrook East End to Painted Desert Indian Center (MP 290 to MP 304)		
None		
Segment 10: Painted Desert Indian Center to Navajo Indian Road (MP 304 to MP 326)		
None		
Segment 11: Navajo Indian Road to Ortega Road (MP 326 to MP 342)		
Statewide Dynamic Message Sign (DMS) Master Plan	DMS design/construction on I-40 Westbound, east of US 191	MP 340.4
Segment 12: Ortega Road to New Mexico State Line (MP 342 to MP 359.63)		
None		

Name of Study	Recommendations	
	Description	Location or Begin Milepost
General Recommendations		
Multimodal Freight Analysis Study	This study addressed all modes of freight transportation in Arizona: trucking, rail and aviation, to provide a detailed assessment of critical freight issues and emerging trends, as well as their relationship to transportation policy and infrastructure. From this information, infrastructure needs and deficiencies were identified, as well as a recommended strategy for including freight analysis as part of Arizona's long-range planning process.	
	Strengthen the relationship between freight and economic development: Engage the private sector in transportation planning and market the link between transportation and Arizona's economy, working with the Arizona Commerce Authority.	
	Coordinate freight planning with local land use planning: Support local government efforts to develop land use planning guidelines for freight-intensive development, and encourage communities to work closely with the private sector when developing freight logistics centers.	
	Preserve and prioritize key freight operations: Support railroad mainline expansions, protect priority highway corridors for efficient freight movement, and establish/maintain a freight data collection program.	
	Enhance freight system safety and security: Incorporate heavy truck movements in highway design, expand Arizona's highway network for freight, and use innovative technology to improve highway operations for commercial technology (e.g., ITS).	
	Seek opportunities to improve freight operations: Target improvements at truck crash "hot spots," provide safe and secure truck parking locations, monitor/improve safety of railroad crossings that have a crash history, and implement performance-based truck size and weight enforcement policies.	
	Promote environmental preservation and energy efficiency: Promote "green" initiatives in the freight sector to lessen impacts on energy consumption, and promote highway alternatives for moving large volumes of freight between southern California and Arizona.	
Arizona State Rail Plan	The Arizona State Rail Plan (SRP) is the first comprehensive assessment of the state's rail needs and was initiated in response to the increasing involvement by ADOT in freight and passenger rail issues. The SRP serves to identify the current rail system, determine infrastructure needs, and include rail projects in the state's long-range planning processes to improve regional and statewide safety and mobility. The principal purpose is to convey the magnitude of rail needs and set forth a policy framework through which strategic actions can be taken to realize the full potential of passenger and freight rail transportation.	
	Partner with Amtrak to improve service along the Southwest Chief Route, and explore feasibility of additional Amtrak service between southern California and Flagstaff.	
	Partner with Grand Canyon Railway and White Mountain Apache community to explore the feasibility of expanding tourist railroad services.	
	Partner with private sponsors to plan and implement new intermodal and freight logistics facilities.	
bqAZ Statewide Transportation Planning Framework Study	The purpose of this effort was to identify Arizona's multimodal transportation needs through 2050. Three alternative transportation scenarios were developed, evaluated, and prioritized to create a comprehensive multimodal framework recommendation for the entire state. The recommended framework is a 40-year vision for the future, including not only multimodal transportation improvements, but also policies and programs to address climate change, urban form, environmental stewardship, economic vitality, and safety and security.	
	Widen all Interstate Highways, including I-40, to six lanes in rural Arizona.	
	Local transit service (e.g., fixed route, community circulator, dial-a-ride) in Flagstaff, Winslow, and Holbrook.	
	Major transit centers in Flagstaff, Winslow, and Holbrook.	
	Minor transit centers at Petrified National Forest, and in Lupton.	
	Intercity bus service along I-40.	
	Enhanced passenger rail service along the BNSF Transcontinental (Transcon) Route.	
	Potential southwest interstate high-speed rail corridor.	

Table C: Funding Programs

Name of Study	Recommendations	
	Description	Location or Begin Milepost
Segment 1: I-17 to US 89 (MP 195.44 to MP 202)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Bridge replacement and rehabilitation at I-17/I-40 Traffic Interchange	MP 195
	Bridge replacement and rehabilitation at Butler Avenue TI Overpass and 4th Street Overpass	MP 198
Segment 2: US 89 to Townsend-Winona Road (MP 202 to MP 212)		
None		
Segment 3: Townsend-Winona Road to Meteor Crater Road (MP 212 to MP 234)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Bridge replacement and rehabilitation at Twin Arrows TI Underpass	MP 219
	Bridge replacement and rehabilitation at Canyon Diablo Bridges EB and WB	MP 229
Segment 4: Meteor Crater Road to SR 99 (MP 234 to MP 246)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Rest area preservation at Painted Cliffs and Meteor Crater rest areas	MP 235
	Bridge replacement and rehabilitation at Meteor City TI Overpass EB and WB	MP 239
Segment 5: SR 99 to SR 87 (MP 246 to MP 258)		
None		
Segment 6: SR 87 to Jack Rabbit Trading Post (MP 258 to MP 270)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Bridge replacement and rehabilitation at Cottonwood Bridge EB and WB	MP 259
	Pavement preservation from Jackrabbit Road (MP 268) to Joseph City (MP 278)	MP 268 - MP 270
Segment 7: Jack Rabbit Trading Post to Holbrook West End (MP 270 to MP 286)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Pavement preservation from Jackrabbit Road (MP 268) to Joseph City (MP 278)	MP 270 - MP 278
	Rockfall mitigation along I-40	MP 279.2 - MP 279.7
Segment 8: Holbrook West End to Holbrook East End (MP 286 to MP 290)		
None		
Segment 9: Holbrook East End to Painted Desert Indian Center (MP 290 to MP 304)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Sign rehabilitation at Goodwater – Yellowhorse	MP 297
	Pavement preservation from Sun Valley Road to Washboard Road	MP 297 - MP 303
	CBC extension at Utility Overpass	MP 298
	Design drainage improvements at Adamana TI	MP 303
Segment 10: Painted Desert Indian Center to Navajo Indian Road (MP 304 to MP 326)		
None		
Segment 11: Navajo Indian Road to Ortega Road (MP 326 to MP 342)		
None		
Segment 12: Ortega Road to New Mexico State Line (MP 342 to MP 359.63)		
2016-2020 Five-Year Transportation Facilities and Construction Program	Pavement preservation from Allentown Road to State Line	MP 354 - MP 260